12-1991

Soybean Tolerance to Simulated Drift Rates of Accent and Beacon

John A. Bailey

SOYBEAN TOLERANCE TO SIMULATED DRIFT RATES OF ACCENT AND BEACON

John A. Bailey and Dr. George Kapusta

Honors Project - PLSS 391

University Honors Program

Southern Illinois University at Carbondale

SUMMARY

Accent and Beacon, both recently labeled postemergent corn herbicides, were applied at 'simulated' drift rates to soybeans at the V3 and R1 development stages. Drift rates were simulated by applying 10 to 50% of the respective labeled rate for each herbicide. Injury was more evident at the V3 stage than at the R1 stage for both herbicides. Injury caused by Beacon was significantly greater than with Accent for both applications, and appears to be a considerable threat for high-risk drift situations when applied near soybeans. Each herbicide exhibited specific, characteristic symptoms of injury that clearly coincided with increases in rate. Yields ranged from 30 to 53 bushels per acre; however, they did not exhibit the extent or variation of damage that was evident in the early injury levels. This was due to considerable recovery of the soybeans toward the end of the season, especially with the Beacon treatments that had initially sustained the most injury.

INTRODUCTION:

The purpose of this study was to evaluate the threat of spray drift injury to soybeans from the corn herbicides Accent and Beacon and to observe and compare the characteristics of such injury at the V3 (second trifoliolate) and R1 (first flower) growth stages.

Spray drift is the "movement of herbicides of target following their release from application equipment" (Ross, 121). Spray drift is influenced by spray droplet size, sprayer boom height, relative humidity, and wind. Spray droplet size is a function of sprayer pressure, nozzle shape and size, and liquid viscosity. Higher sprayer pressure, smaller nozzle orifices, and lower viscosity all decrease droplet size, therefore increasing drift. Increasing boom height on the application equipment also increases the possibility of drift since the wind can carry it further. Also, water from the droplets has more time to evaporate, which naturally decreases droplet size.

Spray drift is a concern for the farmer today for several important reasons. One is public image. Public opinion plays a major role in the future of herbicide use. If public opinion is swayed at the emotional level, as opposed to the intellectual level, by seeing a homeowner's yard killed by spray drift from a nearby field due to a farmer's carelessness, the farmer is doing himself no favor. Secondly, spray that goes off-target is a pure and simple waste of money for the farmer. Thirdly, if spray drift reaches a non-target crop, (whether it be the applicator's or not), the crop, its profits, and even lawsuits may be at stake.

This third reason is the basis for this study. Soybean fields bordering corn fields is a common sight, so drift potential is constant concern. The two herbicides involved, Accent and Beacon (brandnames given the chemicals used for marketing purposes), entered the marketplace in 1990. They are both intended for postemergent use on field corn (after emergence of corn and weeds). So 'simulated' drift rates were used in the study in an attempt to recreate field conditions. This was accomplished by applying 10 to 50% of the respective labeled rate for each herbicide.

HERBICIDES EVALUATED:

Accent 75DF
Beacon 75DF
Prime Oil petroleum crop oil concentrate (83:17)

ABBREVIATIONS USED:

APPL - application
BRDCST - broadcast

CHLOR - chlorosis
COC - crop oil concentrate
IN - inches
LVS - leaves
R1 - soybean development stage, one flower to any node
V3 - second trifoliolate soybean stage
WAA - weeks after application

RESULTS AND DISCUSSION:

Presented in the following tables are soybean stunting, chlorosis, cupping, and necrosis ratings at one through four weeks after treatment, overall injury at six weeks after treatment (essentially stunting), soybean seed moisture at harvest, and soybean yields. Table 1 contains detailed application information. Tables 2 through 28 contain statistically significant data regarding herbicide, herbicide rate, soybean stage at application, and significant combinations of these variables. Only statistically significant data is analyzed in this report. A factorial analysis on the Statistical Analysis Systems program was utilized.

Stunting (Tables 2-10): All variables under observation including herbicide, herbicide rate, and soybean growth stage demonstrated significant differences, with some significant interactions between two, but not all three of the variables.

One week after herbicide application (1 WAA), Beacon already demonstrated significantly greater soybean stunting at both application stages (V3 and R1) than Accent (Table 2). Beacon exhibited virtually no difference between application stages with 44 and 43% stunt at V3 and R1, respectively. Accent, however, caused significantly greater stunting at V3 with 23% than at R1 with 11%. Herbicide rate also influenced stunt at 1 WAA. Both

Accent and Beacon exhibited nearly linear patterns with stunting naturally increasing with an increase in rate (Table 3). Only the 40% rate did not follow the general pattern.

Soybean stunting at 2 WAA began to decrease with Accent at V3 and R1, but Beacon injury continued to increase with 64% at V3 and 48% at R1 (Table 4). This was especially true for the V3 application, which increased 20% from the week before, compared to only 7% for the R1 application. Also at 2 WAA, there was a significant interaction noted between herbicide and herbicide rate (Table 5). Accent caused significantly more stunt at the 40 and 50% rate than the 10, 20, and 30% rates which showed little differences. By contrast, stunt increased significantly with Beacon between the 10 and 20% rates with a 16% increase and then again between the 20 and 30% rates with a 7% increase. From that point, stunting stabilized even though rate increased.

Little change was noted at 3 WAA (Tables 6 and 7) in comparison to the 2 WAA rating. The same significant interactions continued. However, the Accent treatments were recovering slightly, while stunt levels for the Beacon treatment were essentially unchanged.

At 4 WAA, the herbicide and herbicide rate interaction continued with the same pattern (Table 9), with greater differences noted in the Beacon treatments than in the Accent treatments. The herbicide and growth application stage interaction was also similar to 3 WAA with one exception. The R1 application of Beacon began to show considerably less stunting, as opposed to the R1 application which increased from the week

before (Tables 7 and 8). This was due to regrowth of the soybean plants. This regrowth began earlier with the R1 application than the V3 application. Also at 4 WAA, there was a significant between application stage and herbicide rate which was not as evident earlier (Table 10). At the V3 stage, stunting increased significantly with each 10% increment of rate increase, except between the 40 and 50% rates. In contrast, no significant increase was observed between any given 10% increment of rate increase with Beacon. At all rates, V3 stunting was significantly greater than R1 stunting, nearly doubling it in most cases.

Overall soybean injury evaluated at 6 WAA consisted primarily of stunting. The herbicide and application stage interaction indicated slightly decreased levels of injury for both herbicides at V3 and R1 (Table 11). At this point it was evident for the first time that regrowth with the V3 application of Beacon had begun. Both Accent and Beacon continued to elicit more injury at the V3 application stage than the R1 application stage. Injury for the Accent treatments had decreased to 8% at V3 and 2% at R1. Beacon injury was significantly greater with 61% at V3 and 34% at R1. Also at 6 WAA, there was little difference in injury between different rates of Accent (2 to 9%), but Beacon continued to elicit a wide range of injury levels ranging from 21% to 65% (Table 12). The greatest difference was between the 10 to 20 and 20 to 30% rates. This seems to indicate the existence a threshold where injury levels begin to become more serious due to the nature of the plant/herbicide

relationship. This threshold was not as evident with the Accent treatments. This may indicate that further research with Accent on soybeans should involve increased rates while lower rates of Beacon should be included. The application stage and herbicide rate interaction at 6 WAA followed essentially the same pattern as the 4 WAA pattern (Table 13). Injury levels between rates varied much more at V3 than at R1. Also, for any given herbicide rate, injury continued to be significantly higher for the V3 application stage than the R1 application stage.

General comments regarding stunting should include that throughout the season, the highest rate of Accent exhibited significantly less stunting than the lowest rate of Beacon. Also, regrowth of the soybean plants treated with Beacon occurred much later and at a slower rate than the regrowth of the Accent-treated plants.

Leaf Chlorosis (Tables 14-18): Chlorosis (yellowing of plant tissue) was rated on an entire leaf area basis. Accent and Beacon both exhibited characteristic symptoms of chlorosis. Mottled, relatively bright yellow spots were observed on the leaves of soybeans treated with Accent. Beacon treatments were characterized by a pale green to light yellow color across the entire leaf surface with an absence of mottling.

At 1 WAA, herbicide, herbicide rate, and application stage were all significant variables of chlorosis, but no significant interactions of these variables were detected. Although chlorosis was most evident at one week after treatment with

Accent, Beacon, at 55%, still exhibited over twice the chlorotic effects of Accent, at 23% (Table 14). This difference was more evident with R1 treatments than V3 treatments, in that the Accent caused very little chlorosis at R1 while Beacon did elicit significant chlorosis. considering the rate variable alone, increasing herbicide rates at 1 WAA caused a nearly linear increase in chlorosis ranging for 33 to 63% (Table 15). As was previously alluded, chlorosis with the V3 application was significantly greater than with the R1 application with 53% and 26%, respectively (Table 16).

By the second week, chlorosis had faded substantially in the Accent treatments, but was still increasing in the Beacon treatments. Tables 16 and 17 illustrate significant three-way interactions for herbicide, herbicide treatment, and application stage for chlorosis at two and four weeks after treatment. These tables continue to indicate that Beacon chlorosis was significantly more severe and persistent than the Accent chlorosis. At 2 WAA, increasing rates of Accent applied at V3 caused an increase in chlorosis whereas little rate-related difference occurred with the R1 application (Table 17). With Beacon, however, a sharp increase in chlorosis at V3 from the 10 to 20% rate was noted, with little difference between higher rates. With the R1 application, significant increases in chlorosis were observed between the 10 to 20 and 20 to 30% rates, but little increase in the 40 and 50% rates occurred.

At 4 WAA, chlorosis had continued to decrease, especially in the Beacon treatments exhibiting the highest levels of chlorosis

previously (Table 18). Chlorosis in the Accent treatments was hard to detect.

Leaf Cupping (Tables 19-26): Cupping was rated on an entire leaf area basis, with the exception of the first rating (1 WAA for the V3 application), which was initially rated as a percentage of plants exhibiting cupping due to a lack of uniformity of the symptom at 1 WAA. Cupping consisted of leaf puckering (bubbling-like appearance of surface) and the 'drawstring effect' (drawn-in condition of leaf edges) occurring on the leaves of the soybeans treated with Accent. The Beacon treatments exhibited cupping as weakened petioles that caused inversion of the trifoliolates. Later stages of cupping with the Beacon treatments occurred on the regrowth as oblong-shaped (long and narrow) leaflets, especially with the higher rates at the V3 application stage. The cupping effect was associated with chlorosis and followed the same general patterns of injury.

Leaf cupping at 1 WAA was influenced by a three-way interaction between herbicide, herbicide rate, and application stage (Table 19). For the V3 application stage, Accent caused significant variation between rates (14 to 80%) while Beacon caused little variation (81 to 91%). The opposite occurred at the R1 application stage. Relatively little variation in cupping was observed with the different Accent rates (2 to 20%) compared to Beacon which produced 33 to 61% cupping with the R1 application.

At 2 WAA, Accent caused significantly less variation in cupping between rates than Beacon did, and Beacon exhibited much

more cupping than corresponding rates of Accent (Table 20). Both Accent and Beacon exhibited significantly more cupping with the V3 application than the R1 application (Table 21). Table 22 primarily indicates a pronounced increase in cupping between the 10 and 20% rates at the V3 application for both herbicides (18-46%). This is indicative of the threshold previously mentioned where damage levels quickly change which might be further studied.

Cupping decreased at 3 WAA, following the same general pattern and the same interactions (Tables 23, 24, and 25). By 4 WAA, there was essentially no cupping observed in the Accent treatments (Table 26). The Beacon treatments still maintained a pale yellow color with values of 10 to 46% for V3 and 11 to 25% for R1 attributed to cupping.

Leaf Necrosis: (Table 27): Necrosis (death of plant tissue) was rated on an entire leaf area basis. Accent exhibited virtually no necrosis. Beacon caused varying percentages that were as high as 26% at 3 WAA. The 10% Beacon rate at the V3 and R1 application stages caused no significant necrosis. Necrosis for Beacon treatments became hard to detect as the rating period progressed since necrotic leaflets were being masked by regrowth or had dropped off the plant. The V3 Beacon application produced considerably more necrosis than the R1 Beacon application.

Soybean Seed Moisture (Table 27): Soybean seed moisture ranged from 12.2 to 17.9% and depended on the herbicide, rate, and application stage. Data indicated that the two highest Beacon treatments (40 and 50% of the label rate) at the V3 application

stage had a significantly higher moisture percentage at harvest than all other treatments in the study (Table 27). These treatments exhibited the highest amount of injury as well. This indicates that this injury caused a delay in maturity of the soybeans relative to the other treatments.

Soybean Yield (Tables 28-29): Yields ranged from 30 to 53 bushels per acre (bu/A). Table 27 illustrates a significant interaction between herbicide treatment and application stage. Accent yields were significantly higher than Beacon yields, with a 15 and 10 bu/A difference with the V3 and R1 applications, respectively. Application stage did not effect Accent treatment yields. However, Beacon treatments yielded significantly higher with the R1 application than the V3 application. As rates were increased (for both herbicides and both application stages) yields also consistently increased, but not by a large margin (Table 29). Comparing yields with the 53 bu/A average for the untreated checks reveals that all yield losses for all Beacon treatments were statistically significant. While losses for some Accent treatments were considerable, none were statistically significant. Yield data did not show the extent or variation of damage that was evident in the early injury levels of stunting, chlorosis, and cupping. This was due to considerable recovery of the soybeans toward the end of the season.

It is difficult to sat whether Accent and Beacon are a serious threat to soybeans as a result of drift in a real situation since actual rates in a potential drift situation are hard to predict. However, these herbicides are capable of

causing considerable damage to soybeans, especially with Beacon which has substantially more effect on broadleaves than Accent. Naturally, drift injury would potentially be most severe in soybean rows immediately adjacent to a corn field, especially if a strong crosswind was blowing directly toward the soybean field.

SITE DESCRIPTION

Southern Illinois University
SOYBEAN TOLERANCE TO SIMULATED DRIFT RATES OF ACCENT AND BEACON.
Project Code:9120A-ME120 Location :BELLEVILLE RES CNTR
Cooperator : By:GEORGE KAPUSTA

Principal Investigator: GEORGE KAPUSTA Affiliation: SIU
Trial Number: 9120A-ME120 Trial Status: ON-GOING Initiation Date: 4-17-91
Title: SOYBEAN TOLERANCE TO SIMULATED DRIFT RATES OF ACCENT AND BEACON.
State: IL County: ST. CLAIR Country: USA Zip Code: 62221

Crop 1: SOYBEAN Variety: WILLIAMS 82 Planting Date: 5-14-91
Planting Method: ROWS Rate, Unit: 75 , LB/A Depth, Unit: 1.0 , IN
Row Spacing, Unit: 30 , IN
Plot Width, Unit: 10 , FT Plot Length, Unit: 27.5 , FT Reps: 4
Spray Volume GPA: 19.80
Tillage Type: REDUCED-TILL Study Design: RCB
Fertilizer Applied/Other Applications: N 0 LB/A, P2O5 92 LB/A, K2O 60 LB/A
Previous: Crop Year
1. WHEAT/SOYBEAN 90

Texture: SILT LOAM % OM: 1.9 pH: 6.6 CEC: 13
Soil Name: EBBERT Fertility Level: P1 55 LB/A, K 332 LB/A

APPLICATION INFORMATION

	A	B
Application Date:	6-5-91	6-24-91
Time of Day:	10:00	14:00
Application Method:	BRDCST	BRDCST
Application Timing:	V3	R1
Air Temp., Unit:	75 ,F	86 ,F
% Relative Humidity:	46	54
Wind Velocity, Unit:	5 ,MPH	1 ,MPH
Soil Moisture:	FAIR	FAIR

CROP INFORMATION AT EACH APPLICATION

	A	B
Crop 1 Stage:	V3	R1
Stage Scale:	LVS	LVS
Height, Unit:	3-4 ,IN	15 ,IN

APPLICATION EQUIPMENT INFORMATION

	A	B
Appl. Equipment:	CO2 SPRY	CO2 SPRY
Operating Pressure:	40 PSI	40 PSI
Nozzle Type:	FLAT FAN	FLAT FAN
Nozzle Size:	8002	8002
Band Width, Unit:	10 ,FT	10 ,FT

Table 1. Treatment list and application information.

TREATMENTS		FORM.	RATE	UNIT	PROD.RATE	APP.TM/CD	
1	Non treated						
2	Accent	75 DF	.0031	lb ai/A	0.07 oz	V3	A
2	COC	8 L	1.0	% v/v	1.00 %	V3	A
3	Accent	75 DF	.0062	lb ai/A	0.13 oz	V3	A
3	COC	8 L	1.0	% v/v	1.00 %	V3	A
4	Accent	75 DF	.0093	lb ai/A	0.20 oz	V3	A
4	COC	8 L	1.0	% v/v	1.00 %	V3	A
5	Accent	75 DF	.0124	lb ai/A	0.26 oz	V3	A
5	COC	8 L	1.0	% v/v	1.00 %	V3	A
6	Accent	75 DF	.0155	lb ai/A	0.33 oz	V3	A
6	COC	8 L	1.0	% v/v	1.00 %	V3	A
7	Beacon	75 DF	.0036	lb ai/A	0.08 oz	V3	A
7	COC	8 L	1.0	% v/v	1.00 %	V3	A
8	Beacon	75 DF	.0072	lb ai/A	0.15 oz	V3	A
8	COC	8 L	1.0	% v/v	1.00 %	V3	A
9	Beacon	75 DF	.0108	lb ai/A	0.23 oz	V3	A
9	COC	8 L	1.0	% v/v	1.00 %	V3	A
10	Beacon	75 DF	.0144	lb ai/A	0.31 oz	V3	A
10	COC	8 L	1.0	% v/v	1.00 %	V3	A
11	Beacon	75 DF	.0180	lb ai/A	0.38 oz	V3	A
11	COC	8 L	1.0	% v/v	1.00 %	V3	A
12	Accent	75 DF	.0031	lb ai/A	0.07 oz	R1	B
12	COC	8 L	1.0	% v/v	1.00 %	R1	B
13	Accent	75 DF	.0062	lb ai/A	0.13 oz	R1	B
13	COC	8 L	1.0	% v/v	1.00 %	R1	B
14	Accent	75 DF	.0093	lb ai/A	0.20 oz	R1	B
14	COC	8 L	1.0	% v/v	1.00 %	R1	B
15	Accent	75 DF	.0124	lb ai/A	0.26 oz	R1	B
15	COC	8 L	1.0	% v/v	1.00 %	R1	B
16	Accent	75 DF	.0155	lb ai/A	0.33 oz	R1	B
16	COC	8 L	1.0	% v/v	1.00 %	R1	B
17	Beacon	75 DF	.0036	lb ai/A	0.08 oz	R1	B
17	COC	8 L	1.0	% v/v	1.00 %	R1	B
18	Beacon	75 DF	.0072	lb ai/A	0.15 oz	R1	B
18	COC	8 L	1.0	% v/v	1.00 %	R1	B
19	Beacon	75 DF	.0108	lb ai/A	0.23 oz	R1	B
19	COC	8 L	1.0	% v/v	1.00 %	R1	B
20	Beacon	75 DF	.0144	lb ai/A	0.31 oz	R1	B
20	COC	8 L	1.0	% v/v	1.00 %	R1	B
21	Beacon	75 DF	.0180	lb ai/Z	0.38 oz	R1	B
21	COC	8 L	1.0	% v/v	1.00 %	R1	B

Table 2. Soybean stunting 1 week after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	23 b	11 c
Beacon	44 a	43 a

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 3. Soybean stunting 1 week after treatment as influenced by rate of both Accent and Beacon.

Herbicide rate (% of label rate)[a]	Stunt
	(%)[b]
10	23 c
20	28 b
30	31 ab
40	36 a
50	32 ab

[a]10,20,30,40, and 50% of label rate: Accent = 0.0031, 0.0062, 0.0093, 0.0124, and 0.0155 lbai/A, respectively; for Beacon = 0.0036, 0.0072, 0.0108, 0.0144, and 0.0180 lbai/A, respectively.
[b]Values followed by one or more like letters are not significantly different at 5%.

Table 4. Soybean stunting 2 weeks after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	17 c	9 d
Beacon	64 a	48 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 5. Soybean stunting 2 weeks after treatment as influenced by herbicide and herbicide rate.

Herbicide	Herbicide rate, % of label rate[a]				
	10	20	30	40	50
	(Stunting, %)[b]				
Accent	5 e	9 e	11 e	19 d	21 d
Beacon	36 c	53 b	60 a	60 a	63 a

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 6. Soybean stunting 3 weeks after treatment as influenced by herbicide and herbicide rate.

Herbicide	Herbicide rate, % of label rate[a]				
	10	20	30	40	50
	(Stunting, %)[b]				
Accent	3 e	6 e	8 de	14 d	15 d
Beacon	35 c	49 b	57 b	65 a	66 a

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 7. Soybean stunting 3 weeks after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	12 c	6 d
Beacon	63 a	47 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 8. Soybean stunting 4 weeks after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	11 c	3 d
Beacon	66 a	40 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 9. Soybean stunting 4 weeks after treatment as influenced by herbicide and herbicide rate.

Herbicide	Herbicide rate, % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
Accent	3 f	5 ef	6 ef	12 d	9 de
Beacon	33 c	47 b	58 a	64 a	63 b

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 10. Soybean stunting 4 weeks after treatment as influenced by herbicide rate and application stage.

Growth stage at application	Herbicide rate, % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
V3	24 de	34 c	40 b	50 a	45 ab
R1	12 f	18 ef	24 de	26 d	28 d

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 11. Soybean injury 6 weeks after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	8 c	2 d
Beacon	61 a	34 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 12. Soybean injury 6 weeks after treatment as influenced by herbicide and herbicide rate.

Herbicide	Herbicide application rate - % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
Accent	2 e	3 e	4 e	9 e	6 e
Beacon	21 d	39 c	54 b	59 ab	65 a

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 13. Soybean injury 6 weeks after treatment as influenced by herbicide rate and application stage.

Application stage	Herbicide rate - % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
V3	16 e	29 c	38 b	48 a	44 ab
R1	8 f	14 ef	20 e	21 ed	27 cd

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 14. Soybean leaf chlorosis at 1 week after treatment as influenced by herbicide.

Herbicide	Chlorosis
	(%)[a]
Accent	23 b
Beacon	55 a

[a]Values followed by like letters are not significantly different at 5%.

Table 15. Soybean leaf chlorosis at 1 week after treatment as influenced by rate of Accent and Beacon.

Herbicide rate (% of label rate)[a]	Chlorosis (%)[b]
10	33 d
20	42 c
30	49 bc
40	53 b
50	64 a

[a]See Table 3 for rates.
[b]Values followed by one or more like letters are not significantly different at 5%.

Table 16. Soybean leaf chlorosis at 1 week after treatment as influenced by herbicide application stage.

Application stage	Chlorosis (%)[a]
V3	53 a
R1	26 b

[a]Values followed by like letters are not significantly different at 5%.

Table 17. Soybean chlorosis at 2 weeks after treatment as influenced by herbicide, herbicide rate, and application stage.

	Herbicide			
	Accent		Beacon	
	Growth stage at application		Growth stage at application	
Herbicide rate (% of labe rate)[a]	V3	R1	V3	R1
	(%)[b]			
10	6 ef	1 f	30 bc	14 de
20	5 ef	2 f	68 a	25 c
30	6 ef	4 ef	73 a	35 b
40	16 d	6 ef	73 a	33 bc
50	14 de	7 ef	64 a	39 b

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 18. Soybean leaf chlorosis at 4 weeks after treatment as influenced by herbicide, herbicide rate, and application stage.

Herbicide rate (% of labe rate)[a]	Herbicide			
	Accent		Beacon	
	Growth stage at application		Growth stage at application	
	V3	R1	V3	R1
	(%)[b]			
10	1 gh	1 gh	9 de	5 e-h
20	3 fgh	0 gh	16 c	6 d-g
30	1 gh	1 h	23 b	8 def
40	6 d-g	3 fgh	30 a	9 de
50	1 gh	3 fgh	28 a	11 d

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 19. Soybean leaf cupping at 1 week after treatment as influenced by herbicide, herbicide rate, and application stage.

Herbicide rate (% of labe rate)[a]	Herbicide			
	Accent		Beacon	
	Growth stage at application		Growth stage at application	
	V3[b]	R1	V3[b]	R1
	(%)[c]			
10	14 ghi	2 i	83 ab	33 efg
20	29 fgh	5 i	86 ab	48 de
30	49 de	11 hi	83 ab	54 cd
40	71 bc	14 ghi	81 ab	46 def
50	80 ab	20 ghi	91 a	61 cd

[a]See Table 3 for rates.
[b]Cupping rated on per plant basis for 1 WAT, V3 rating; as oppossed to entire leaf area basis for all remaining ratings. This is due to non-uniformity of cupping effect during first week after application.
[c]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 20. Soybean leaf cupping at 2 weeks after treatment as influenced by herbicide and herbicide rate.

Herbicide	Herbicide rate - % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
Accent	3 e	8 de	9 de	12 d	15 cd
Beacon	21 c	52 b	62 a	64 a	66 a

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 21. Soybean leaf cupping at 2 weeks after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	16 c	3 d
Beacon	71 a	35 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 22. Soybean leaf cupping at 2 weeks after treatment as influenced by herbicide rate and application stage.

Growth stage at application	Herbicide rate - % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
V3	18 cd	46 a	48 a	52 a	53 a
R1	7 e	14 de	23 bc	24 bc	28 b

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 23. Soybean leaf cupping at 3 weeks after treatment as influenced by herbicide and herbicide rate.

Herbicide	Herbicide rate - % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
Accent	3 e	4 de	4 de	9 de	6 de
Beacon	11 d	23 c	40 b	46 a	51 a

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 24. Soybean leaf cupping at 3 weeks after treatment as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(%)[a]	
Accent	9 c	2 d
Beacon	44 a	25 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 25. Soybean leaf cupping at 3 weeks after treatment as influenced by herbicide rate and application stage.

Growth stage at application	Herbicide rate - % of label rate[a]				
	10	20	30	40	50
	(%)[b]				
V3	10 efg	18 cd	30 b	39 a	35 ab
R1	4 g	9 fg	14 def	16 cde	22 c

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 26. Soybean leaf cupping at 4 weeks after treatment as influenced by herbicide, herbicide rate, and application stage.

Herbicide rate (% of label rate)[a]	Herbicide			
	Accent		Beacon	
	Growth stage at application			
	V3	R1	V3	R1
	(%)[b]			
10	2 hi	0 i	10 e-h	11 efg
20	4 ghi	0 i	23 d	14 e
30	4 ghi	0 i	36 c	14 e
40	5 f-i	1 i	54 a	13 ef
50	3 hi	2 hi	46 b	25 d

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 27. Soybean moisture at harvest as influenced by herbicide, herbicide rate, and application stage.

Herbicide rate (% of labe rate)[a]	Herbicide			
	Accent		Beacon	
	Growth stage at application			
	V3	R1	V3	R1
	(%)[b]			
10	12.5 b	13.2 b	13.0 b	13.7 b
20	12.9 b	12.8 b	13.0 b	12.7 b
30	12.5 b	12.4 b	14.0 b	12.8 b
40	13.0 b	12.6 b	17.2 a	13.1 b
50	12.4 b	12.2 b	17.9 a	12.8 b

[a]See Table 3 for rates.
[b]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 28. Soybean yield as influenced by herbicide and application stage.

Herbicide	Growth stage at application	
	V3	R1
	(Bu/A)[a]	
Accent	49 a	49 a
Beacon	34 c	39 b

[a]Values within and between columns followed by one or more like letters are not significantly different at 5%.

Table 29. Soybean yield as influenced by rate of both Accent and Beacon.

Herbicide rate (% of label rate)[a]	Chlorosis
	---------(Bu/A)---------
10	46 a
20	45 ab
30	42 ab
40	41 b
50	41 b

[a]See Table 3 for rates.
[b]Values followed by one or more like letters are not significantly different at 5%.

REFERENCES

Ross, Merrill A. and Carole A. Lambi. 1985. Applied Weed Science. Burgess Publishing Company, Minneapolis. pp. 121-122.

Statistical Analysis Systems. 1982. SAS User's Guide. SAS Inst., Cary, N.C.